

National Park Service
U.S. Department of the Interior

New River Gorge National River
Gauley River National Recreation Area
Bluestone National Scenic River
Glen Jean, West Virginia



2006 Peregrine Falcon (*Falco peregrinus*) Restoration Project Summary

Program Report NPS/NER/NERI—1419-06PF



ON THE COVER

Left: Hack box *Upper Right:* Fledged falcon following release from the hack box

Lower Right: Juvenile falcons within the hack box prior to release

Photographs by: Gary Hartley and Matthew Varner

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Abstract

In 2006, 15 nestling peregrine falcons (*Falco peregrinus*) or eyasses were released over the course of three separate release events using techniques outlined by Sherrod et al. (1982) for hacking falcons. Prior to release, one eyas died because of a skull talon puncture delivered by a falcon sibling. Following release, only one falcon vacated the general hack area or postfledging area (PFA) in less than the recommended threshold of 14 days. The release success exhibited at NERI of nearly 94% may be some of the highest documented instances on record for hacked peregrine falcons.

Executive Summary

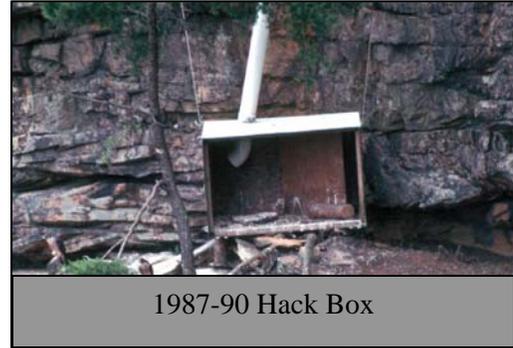
From April through September of 2006, 15 peregrine falcon eyasses were hacked using three staggered releases from a secluded location within NERI. The eyasses were taken from five different sites in two states, VA and NJ. One falcon died prior to release into the gorge and one falcon prematurely dispersed from the hack box following release. Hacking success was defined as falcon dispersal after spending ≥ 14 days following release within the PFA, which equated to a 93.8% success rate for the NERI hacking effort. Over 400 hours of observational data were collected by NPS staff, WV Division of Natural Resources personnel, and volunteers. Adult nesting surveys utilizing helicopters will become increasingly important as this project continues to insure identification and protection of eyries and the implementation of appropriate actions to protect fledgling falcons from intraspecific predation.

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Introduction

Peregrine falcons (*Falco peregrinus*) have never been documented using sites within New River Gorge National River (NERI) or within the Gauley River National Recreation Area (GARI) as nesting habitat. Observations of adult falcons have been made during spring observation periods; yet no nest locations were located. Given the distribution of historic breeding sites in the Appalachian region, it is plausible that peregrine falcons have historically nested undetected within NERI or GARI, which provide extensive cliffline habitats. The cliffline habitats of NERI were the site of a hacking program from 1987 to 1990. Hacking refers to the housing of juvenile raptors in rearing boxes at sites chosen for release, then releasing them at ages coinciding with their ability to fledge and sustain flight (Sherrod et al. 1982). During the 1987-90 hacking effort, thirty young peregrine falcons were released; 28 of which successfully took flight. Throughout the 1990s sporadic sightings of peregrine falcons have occurred, but no verified records of established eyries or nest sites in the gorge have been documented. It is unclear why the 1987-1990 hacking failed to result in the establishment of nesting pairs; however, falcon experts, survey findings, and recent literature support the conclusion that suitable peregrine falcon nesting habitat exists within NERI. The other critical component that plays a pivotal role in nest site selection is prey availability. The following paragraphs explore both of these aspects of peregrine habitat suitability.



Nesting Habitat Quality

One species of passerine known to nest in the cliff habitats of NERI are common ravens (*Corax corax*). Sergio et al. (2004) noted that peregrine falcons select for sites in proximity to raven nests presumably as a strategy for early warning of an impending predators arrival. In addition, White et al. (2002) noted that peregrine falcons oftentimes would utilize old raven nests as eyries, suggesting that the two species actively select for similar nest site characteristics. During a 2003 helicopter survey, which evaluated cliff habitats within three states, six common raven nests were identified within NERI. In addition, the number of raven nests within NERI equated to 20% of all nests located for this species out of the 242 cliff lines surveyed across three states, further supporting the notion that NERI provides suitable peregrine falcon nesting habitat. Consequently, the two areas that have documented breeding peregrine falcons collectively contained 53% of the documented common raven nests noted during the survey. All of the common raven nest locations, except for one, occur within 1.8 miles of the 1987-1990 hack site. Additional raven nests exist within NERI and were undetected due to the limited extent of the survey, which resulted in less than 28% (15.55 miles) of NERI cliffs being inventoried.

Mike Britten, an NPS ecologist from the Intermountain Support Office, Intermountain Region, submitted a report to NERI in 2001 outlining his evaluation of peregrine habitats in New River Gorge. This report was based upon Mr. Britten's 20+ years of experience

working with and observing peregrine falcon behavior and habitat use across the western United States and Alaska, which included observations of more than 250 nesting pairs of peregrines. He noted that "...the rocks of the Endless Wall, Nuttall Cliffs, and Kaymoor provide many suitable nest sites for peregrines". The 2006 aerial surveys performed by peregrine falcon experts from the Center for Conservation Biology at the College of William and Mary (CCBWM) further supported Britten's conclusions. The draft findings of CCBWM highlight the New River as being one of the top six areas in the region with "significant rock formations that contain multiple sites that could support cliff-dependent species such as the peregrine falcon" (Watts 2006). In fact, the most extensive cliff habitats, exhibiting the greatest height above tree canopy and lowest occlusion by vegetation, which are important factors in falcon nest site selection, are the exact areas mentioned in Britten's 2001 report.

Two possible explanations in the myriad of potential factors affecting the lack of known nest locations in NERI or GARI are survey limitations and recreational use. During the courtship period, which generally takes place between late February through April with some latitudinal variation, access into remote areas of the park units to observe cliff habitats is difficult. Some cliff habitats are accessible only via the river making early spring observation periods impossible. Several remote areas of NERI were identified as having high quality cliff habitats by the draft CCBWM report (Watts 2006). Additionally, remote portions of GARI offer extensive cliff habitats with complex horizontal strata, less than moderate vegetative occlusion, and exceed tree canopies by greater than ~30m. The other factor, recreational use, is regulated by the NERI Climbing Management Plan which states that from "...mid-February through April, national river staff would seek voluntary compliance for a reduction of recreational use..." and "...if peregrine courtship behavior is observed, the site would be closed with an appropriate buffer until two weeks after the young had fledged or until nest failure was proven". Although hundreds of hours have been spent by both park staff and volunteers, the likelihood of observing a pair of falcons is minimal given the spatial extent of the park units. The rugged terrain, time of year, and limited period that a pair of falcons would search an area contribute to the relative inadequacy of this monitoring technique. The impacts from recreation, specifically rock climbing, have largely been unknown until recently. In 2004, Brambilla et al. published findings based upon 29 falcon pairs that noted where nesting ravens, peregrine falcons and rock climbing coexisted no falcons were fledged compared to areas without rock climbing activities where fledgling success approached 79%. Brambilla et al. (2004) concluded that rock climbing should be regulated or banned in the proximity of peregrine falcon nests, especially those that contain nesting ravens. On April 17, 2006, during the aerial survey of Endless Wall, which is a 1 mile stretch cliffline, eight rock climbers were noted (Watts 2006).

The dilemma of balancing recreation use and insuring that the activities do not lead to falcon refusal of suitable habitat within the park units will likely continue for years to come. The key to the issue will be observations of falcon pairs within the gorge and documentation of their response to climbing activities. Implementation of appropriate climbing restrictions in a timely manner will also become a challenge if a courting pair of falcons is observed. No one knows if, for example, one climber in proximity to a preferred site for one hour will result in a courting pair vacating the area. Consequently,

rapid implementation and strict enforcement of closed routes would be critical. Recently, a closure protocol was jointly developed by WVDNR, the Access Fund, and NPS staff; which will allow for rapid implementation of protective measures if falcons are sighted during the breeding season (February - April).

Prey Availability

The diet of peregrine falcons is highly variable and prey availability in proximity to nest sites was noted by Newton (1988) as not being as important as nest habitat quality. Diets have been documented to include a variety of avian prey, but generally are dominated by thrushes (Turdidae), doves (Columbidae), starlings (Sturnidae), woodpeckers (Picidae), waterfowl species (Anatidae) and crows/jays (Corvidae) (Rizzolli et al. 2005, Peregrine Fund 2007, Dzialak et al. 2005a). All of these families are well represented within close proximity of cliffs exhibiting suitable nest habitat within NERI. Tucker et al. (2000) noted that peregrine falcons regularly hunt within 1.5km of nesting cliffs, but some may travel 20-43km on hunting flights (Enderson and Craig 1997). Enderson and Craig (2004) noted that males hunted within 8km of eyries 60% of the time while females hunted within 23km of the eyrie about 75% of the time. Based on range of hunting flight distances, falcons nesting along the northern portion of NERI would have access to a broad array of habitats during both short and long hunting excursions. The matrix of forest and open habitats would be expected to provide sufficient prey to sustain nesting falcons, especially considering that the extended hunting distances potentially could include the surrounding seven county area based upon Enderson and Craig (1997, 2004). M. Britten (personal communication, 2001) noted that exposure of avian prey due to topographic complexity within the gorge would improve hunting foray success of peregrine falcons.

The likelihood of peregrine falcon nesting within NERI and GARI had stagnated prior to 2006. However, efforts by CCBWM prompted the initiation of a multi-state, multi-agency, cooperative effort to “hack” falcons once again in the gorge. The duration of the project is 3-5 years, with an annual target release of 15-25 falcons. The young falcons would be brought to NERI from bridge nests spread across coastal Virginia, New Jersey, and/or Maryland. These nests exhibit poor survival rates due to premature fledging over open water and collisions with vehicles traveling on the bridges, thus making them ideal falcons for the hacking program.

The project’s long-term objective would be to establish adult nesting peregrine falcons within NERI and GARI. During the summer (June-August) of 2006, 15 eyasses were released within the gorge.

Study Area

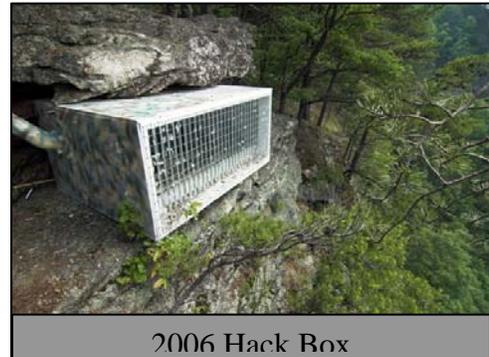
The hack site is located in Fayette County, West Virginia, in a portion of the NERI with extensive cliffline habitats. NERI is approximately 28,329 ha and is located in the Appalachian Plateau physiographic province. Steep slopes and exposed rock cliffs ascending 300 m above the rivers to plateau-like ridge tops characterize this province. Oaks (*Quercus* spp.) dominate the

forest overstory, while the understory mainly consists of rhododendron (*Rhododendron maximum*).

Methods

In April of 2006, park staff members began working with local climbers to select potential hack sites. Staff members from the park and WVDNR further evaluated the potential sites to determine the best possible location for the eventual release. The primary hack site was selected based upon safety from predators, reduced opportunity for human disturbance, and reasonable access for hack site attendants. Additionally, because of the topography of the site, it would not be affected by climbing activities in the gorge.

The hack box was built using dimensions taken from the site and schematics from Sherrod et al. (1982). The box floor was lined with pebbles and wood debris to facilitate talon dexterity development and to elevate the eyasses from waste. The box was temporarily attached to the cliff face at a secluded location.



2006 Hack Box

Following Sherrod et al. (1982), we released 15 peregrine falcons from a single hack site during two staggered releases located in the northern portion of NERI. We utilized a daily feeding and observation schedule based upon Sherrod et al. (1982). Unlike the previous NERI hacking effort, the box was cleaned at least twice per week to reduce stress on the eyasses resulting from maggot development within their ears and from swarming wasps. All birds were banded using standard band sizes for the species (male 6, female 7A or 7B) (Hull 2001). With the exception of one falcon, all eyasses were banded on both legs, which allowed for the use of color-coded identification bands in addition to the standard alphanumeric bands. Following the release of the falcons, the daily feeding regiment continued for 4-6 weeks, gradually tapering down the food amounts to entice the young birds to pursue prey on their own. Observers documented daily weather conditions and recorded continuous falcon activity levels of individual birds using a standardized form developed by the NPS. We classified the fate of each individual as having been hacked successfully or hacked unsuccessfully.

Success was defined as dispersal after spending ≥ 14 days following release within the general hack area or postfledging area (PFA). Conversely, we considered hacking unsuccessful if the individual died before release or dispersed prematurely < 14 days after release (Powell et al. 2002, Dzialak et al. 2006). From June through August, three staggered releases involving 15 eyasses were completed. The average release cohort was five individuals ($n=1-8$).



Alphanumeric and color taped
U.S. Fish and Wildlife Service
leg bands

Results

From May 31 through August 24, 15 peregrine falcon eyasses were hacked into NERI. The eyasses were taken from five different sites in two states, VA and NJ, resulting in three staggered hacks of falcons in 2006. The first group of falcons, which were from two different nests, arrived in NERI on May 30. Four females and one male were taken from the James River Reserve Fleet in VA and were approximately 28 days old. The second group was taken from the Norris Bridge in VA and was comprised of two females and one male that were approximately 35 days old. Initially, both groups were taken to Shenandoah NP where the different nest cohorts were kept in a divided hack box for 6 days. This was necessary given the age differences between the eyasses. Once the younger group reached 40 days old, they could safely be integrated into a single hack box with the older group. After arriving at NERI, the eyasses were shuttled to the hack box and thawed feeder quail were dropped into the box using a 6" PVC tube attached to the box. The eyasses received a morning and afternoon feeding regiment that included 1.5 quail per eyas per day. Daily observations of the eyasses development was implemented using small (<1") viewing holes and strategically located door peeps. The feeding regiment continued until approximately two days prior to release at which point the feeding was halted to reduce premature flight from the hack site.

Mortality

On June 6, one female eyas (black 14/green V) was found dead in the box. The park biologist and raptor experts from Three Rivers Avian Center investigated the mortality and concluded that it was a result of a cranial talon puncture inadvertently delivered by one of the hack box cohorts.

Group One

On the morning of June 15, over one dozen feeder quail were dispersed on the ground outside of the hack box and the door was engineered to open from a concealed location over 100ft from the site. WVDNR personnel, staff from Three Rivers Avian Center, and NPS biologists were on site during the release. At 1041hrs the box door was opened and within 15 minutes one bird (L green; R black 07/green W) had taken flight. At 1125hrs the last eyas (R purple; L black 17/green V) emerged from the box. The four eyasses around the hack box fed upon the feeder quail and explored the adjacent cliffline on foot before beginning to individually take flight at 1530hrs. All four eyasses were observed successfully landing in trees within the PFA until observations concluded at 2000hrs. The following day all the eyasses were accounted for in flight and roosting within the PFA. Daily observations of the PFA by WVDNR personnel, staff from Three Rivers Avian Center, volunteers and NPS staff tracked the progression of the eyasses development. Generally, activity was divided among four categories: feeding, roosting, soaring, and chasing. The bulk of their activity was spent roosting and flying in proximity to the hack box during the initial few weeks and later progressed to roosting upriver out of sight of the hack box and extended flights within the gorge. All six released eyasses dispersed successfully with a median and average duration of stay within the PFA of 33.5 and 37.83 days, respectively.



Group 1 – May 31

Group Two

The second group of falcons arrived at NERI on June 23. Unlike the first group, the second group of eyasses was skewed toward the male sex. However, they were taken from two nest locations similar to the first group and were approximately 35 days old upon arrival at NERI. One cohort was composed of five males and one female, which were taken from Godwin Island Bridge. The other cohort was composed of one male and one female, which were taken from Cobb Bridge in Virginia. Similar to the first group, the eyasses were fed and observed for a period of time twice daily until two days prior to release. On July 6, 2006 the birds were released using the technique described for the first group of eyasses. One eyas took premature flight following the opening of the box, but the remaining members of the second group milled around the hack box feeding on the quail that were left. By noon, four of the second group were flying within the PFA and being playfully engaged by the first group of falcons. Throughout the day, all of the first group of falcons were observed in flight within the PFA. The following day all the eyasses were accounted for in flight and roosting within the PFA. However, one male (R silver; L black 14/green W) was not observed feeding and was only seen during the day following release approximately 150m from the hack box. Daily observations of the PFA by WVDNR personnel, staff from Three Rivers Avian Center, volunteers and NPS staff tracked the progression of the eyasses development. Like the first group, activity was primarily divided among four categories: feeding, roosting, soaring, and chasing. However, the interaction with the first group appeared to accelerate the second group's development. The second group appeared to spend a greater amount of time in flight activity rather than roosting like the first group.

The second group remained within the PFA for a median and average duration of 31 and 29.3 days, respectively. Seven released eyasses dispersed successfully and one dispersed prematurely equating to an 87.5% success rate. Of the successfully dispersed eyasses, 28.57% were female (n=2) and 71.43% were male (n=5).

Group Three

The third group was comprised of a single falcon that was successfully reared by two peregrine falcons nesting on the Walt Whitman Bridge in NJ. Based on communication with the United States Fish and Wildlife Service personnel in NJ, the nesting peregrines produced two offspring. However, only one of the eyasses successfully took flight. The other eyas attempted flight and landed along the rocky shoreline, which resulted in minor injuries to the young



Group 2 – June 23



Playful Flight Interaction



Group 3 – July 17

falcon that prevented it from resuming flight. The bird was taken to Tri-State Bird Rescue and Research, Inc located in Newark, NJ. The clinic rehabilitated the young falcon over the course of a couple of weeks and on July 16, volunteers shuttled him to NERI. The bird was banded with a single metal band on its left leg and was between 50 and 60 days old. Due to the above average temperatures and humidity, the bird was harbored in a covered carrier overnight with air temperatures set at 20 degrees Celsius. On July 17, the male eyas was transported to the hack site and placed in the hack box. On July 19, the eyas was released using the standard procedures followed during the previous releases. The silver-banded male was observed throughout the next 25 days and was one of the last three falcons to leave the PFA and head south for winter.

Discussion

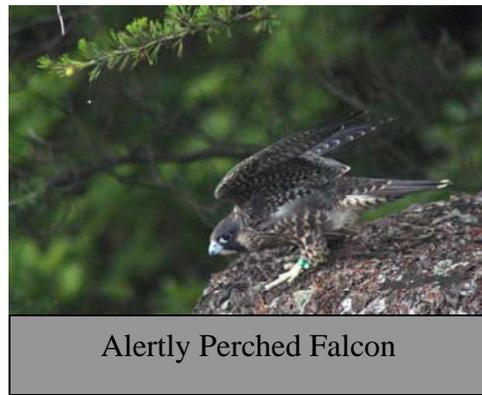
Although, one falcon died prior to release into the gorge, the first year of the peregrine falcon hacking program was successful. The release of 15 eyasses using three staggered hacks was a collaborative step toward the establishment of peregrines within NERI and GARI. Multiple agencies, user groups, and raptor experts were engaged throughout the hacking project, which greatly contributed toward its first year success. Observations of the eyasses within the PFA were conducted primarily by NPS staff and local birding enthusiasts thereby allowing for the compilation of over 400 hours of observational data within the PFA.

Observational data was only given a cursory review based upon time constraints in the development of this report; however, behavior shifts were noted based upon the progression through four stages of increased independence (Dzialak 2005b, Howard 1960). The first stage (fledging) was characterized by the period immediately following release and was defined as a general restriction of movement by a falcon within the PFA (see Map). The second stage (foray) was defined as frequent movement beyond the observational capacity of observers and subsequent return to hack site. The third stage (transience) was defined as the initiation of wandering behavior, at which time peregrines did not make regular returns to the PFA or hack site. The fourth stage (colonization) was defined as a peregrine having established a defended territory. The ground based observational data limited the ability to collect data on the third and fourth stages of independence. Although the break from the second to the third stage can be roughly identified based upon reduced sightings of a particular bird within the PFA. Generally within the first 14 days following release, falcons would begin foray movements upstream of the PFA. The first group explored the upstream river right segments of the gorge where a preferred roosting area (Beauty Mountain) developed. In contrast, the second group of falcons developed an affinity for the downstream river left segments of the gorge, developing a preference for roosting along the Kaymoor cliff bands.



Flight development was rapid following release. Within a few hours of release, falcons from previous releases were not discernable on the wing based upon flight abilities. The second and

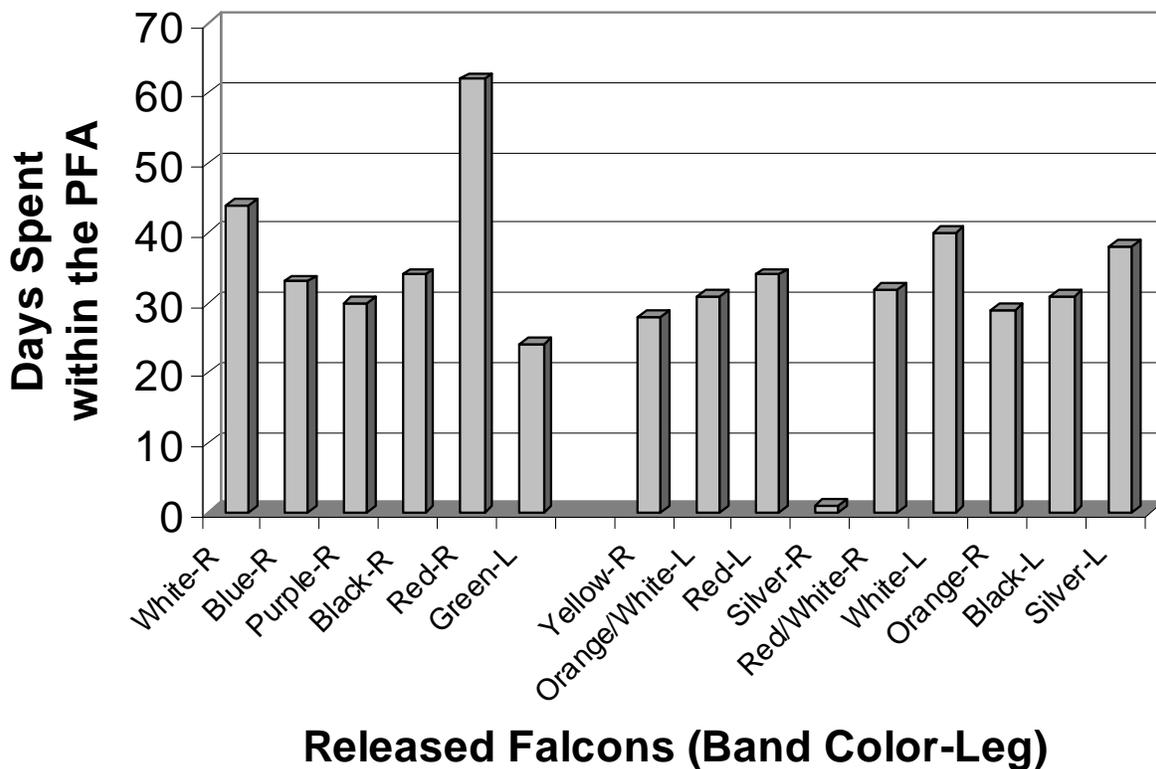
third group of falcons gained independence more quickly than the first group, entering the foray stage within several days on the wing. Yet the duration of time falcons from this group were observed within the PFA was nearly the same as the first group. The more rapid development is likely attributed to the interaction with the previously hacked falcons.



Timing of dispersal among peregrines released at NERI was similar to that observed in other studies.

Peregrines at NERI remained on the PFA for an average of 32.7 days. Dzialak et al. (2005) reported an average of 16-31 days based upon falcons released at two sites in Kentucky. Fyfe (1988) and Powell et al. (2002) reported a postfledging period of 23–30 days among peregrines hacked in Canada and Iowa. Some experts have suggested that there is a survival or reproductive advantage associated with remaining on the PFA for an extended period, yet some research suggests that individuals that disperse earlier are in better physical condition than late dispersers (Belthoff & Dufty, 1998; Willey & van Riper, 2000).

Figure 1. Duration of Stay within the PFA



Barclay and Cade (1983) suggested that raptor hacking programs generally achieve 75% success. Burnham et al. (1988) estimated that about 81% of hacked peregrines survived at least 3 weeks.

The 2006 hack at NERI resulted in 93.8% success to release and all but one of the falcons met the ≥ 14 days criteria to be considered a successfully released falcon. Typically, survival-to-dispersal among wild-produced peregrines is lower and has been reported to be 26-47% (Enderson 1969, Nelson 1988, Ratcliffe 1993, Vorisek 2005). Barclay and Cade (1983) reported hacking success of 63%, 79%, and 83% for peregrines hacked on cliffs, towers, and urban sites, respectively. Dzialak et al. (2006) reported a 50% success rate of hacked falcons in Kentucky from 2001-2003. Therefore, the release success exhibited by NERI of nearly 94% may be some of the highest documented instances on record. The results also refute theories that predation by Great Horned owls (*Bubo virginianus*) would result in partial or complete failure of wild peregrine eyasses from potential future naturally nesting peregrines. Hacked falcons are recognized as being highly susceptible to avian predators due to the absence of parental adult falcons, which aggressively exclude owls, hawks, etc. from the area around the eyrie (Sherrod 1982). Twenty-four days was the shortest range of days that any of the hacked falcons were noted, which is generally considered outside of the period of greatest susceptibility for the young falcons. Additionally, research has shown that avian species, such as peregrine falcons, comprise less than 6% of individual prey items consumed by Great Horned owls. No confirmed Great Horned owl territories exist within the PFA.

In the Midwest, where peregrine falcons have nested almost exclusively on man-made structures over the last decade, falcons have expanded nest locations to include cliff habitats (e.g. Tordoff 2000, 2005). This shift in habitat use is expected to continue with falcons occupying man-made structures followed by cliff habitats (Dzialak et al. 2005). From 2004-2005, nest sites in the Midwest were located on cliff outcrops 16-32% of the time. Continued release of peregrine falcons within NERI coupled with increasing Midwest and Coastal falcon populations will increase the likelihood of falcons nesting within the gorge and surrounding region. Spring courtship surveys and the continued development of partnerships with recreational groups, especially rock climbers, will be fundamental to the success of this endeavor.

Management Recommendations

The success of the 2006 peregrine hacking effort is a major accomplishment for the NERI wildlife program. The support of WVDNR and local birding enthusiasts, who volunteered hundreds of hours on the project, was critical to the establishment of this long-term endeavor. Below is a list of recommendations that should be implemented in 2007-2010 to insure continued success of this project.

2007-2010

- Install interior hack box cameras and exterior site overview cameras
 - These cameras add a security component to the project that is critical to the long term success of the effort
 - These cameras increase the park's ability to document eyas behavior and development
- Develop Canyon Rim Visitor Center peregrine display, equipped with real time footage of peregrine activity at the site and looped footage featuring exciting moments in the eyasses' development
 - Engaging and educating the public has been and will continue to be fundamental to the project's success at NERI.
- Install a second hack box at the primary site to allow for cohort manipulation and segregation to improve release success.
 - WVDNR is contributing the materials necessary to fulfill this task, which will allow NERI to be less reliant on SHEN for harboring eyasses that are too young to be integrated into another nest cohort.
- Expand the spring courtship observation area to encompass all known outcrops within NERI and GARI, focusing on cliff bands with known raven nest locations.
- Purchase a new server to host the hack site camera footage
 - The implementation of a "web cam" will allow for remote viewing of the site from headquarters.
 - This would also allow the public to view falcon activity at the hack site from their personal computer.
- Schedule at least two spring flights through NERI and GARI to determine if peregrine nesting is occurring within the park units, beginning in 2008 and continuing through 2013.
 - Modify hacking procedures if adult nesting is occurring in proximity to existing hack location to protect fledgling falcons from predation
- Continued hacking of 15-25 eyasses each year until 2010

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